Helicopter Ambulances in Critical Care

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SUMMARY: The origins of aeromedical transport lie in the ferrying of wounded soldiers to hospital. This paper outlines the history of aeromedical evacuation and examines American military and civil experience.

Introduction

Britain has been slow in developing helicopter ambulances, although the Armed Services have been using helicopters for rescue purposes for many years.

There is a drive to improve trauma management in Britain; the helicopter ambulance provides the ability to take advanced resuscitative techniques to the critically ill or injured patient, and to transport that patient quickly to the most appropriate hospital. The need for the helicopter within Britain's ambulance system is controversial but in some areas the speed and versatility of the helicopter makes it cost-effective.

History

The first reported aeromedical evacuation took place during the Franco-Prussian War of 1870-71, when balloons carried wounded soldiers from the besieged city of Paris (1). During World War 1, the British Army transported some casualties strapped on the rear fuselage of aircraft (Fig 1), and for the "Z" Expedition to British Somaliland in 1920, the Royal Air Force modified a De Havilland 9 bomber to enable stretcher-borne patients to be carried in a chamber within the rear fuselage. This was the first dedicated ambulance aircraft (2).

Fig 1. During WW1, there were rare instances of aircraft being used to evacuate casualties.

In 1945, the helicopter was first used for casualty evacuation when an injured British soldier was lifted out of the Burma jungle by a US Army Sikorski aircraft (3). During the Korean War, the 3rd Air Rescue Squadron, a United States Air Force helicopter unit tasked with recovering aircrew who had ejected, used externally-mounted stretchers to carry wounded soldiers (1). This expanded into a network of rescue units, controlled by medical officers and with paramedics in the flight crews. Some 20,000 casualties were air-lifted during the Korean War. In Vietnam an efficient rescue service was developed which became known by its radio call-sign "DUSTOFF". Between 1964 and 1969, 370,000 wounded troops were airlifted to hospital by Dustoff helicopters (4). No combat area in Vietnam was more than 35 minutes flying away from a resuscitation unit (5,6).

In comparison with earlier conflicts, helicopter transport has been cited as a major factor in reducing the casualty mortality rate (3,7). The progressively more rapid transport of casualties coincides with a successive drop in mortality rate, which cannot be accounted for entirely by advances in hospital management. For every 30 minute delay in treatment of severely injured patients, the mortality rate rises by 300% (5).

In the United States in the mid-1960s, Dustoff expertise was applied by the US Army to rescue casualties from civil air accidents. This experiment, Operation Flatiron, was expanded to include victims of Road Traffic Accidents (RTA), and encouraging results led to the funding of several projects under the 1966 Highway Safety Act (5).

Resuscitation

Experience suggests that the prompt application of effective resuscitation techniques is more important than the early arrival of the patient at hospital (3,7,8). By having a doctor as an integral member of the flight team, definitive resuscitation and intervention can be instituted earlier, preferably during the "golden hour" following injury. The medical officer should be a resuscitation or trauma specialist, assisted by a nurse or paramedic trained in Advanced Trauma Life Support and Advanced Cardiac Life Support (7,9). The helicopter medical team effectively extends the reach of the tertiary care hospital. Intervention at the scene of injury and during flight may

include airway control by cricothyrotomy, tracheostomy or endotracheal intubation, assisted ventilation, insertion of chest drains, fluid and blood replacement, application of MAST trousers, and CPR (1,3).

Studies of trauma victim transport, collated by the American College of Surgeons Committee on Trauma, show a significant decrease in the mortality rate of patients transported by helicopter, compared with those moved by road ambulance (10). Baxt and Moody (11) compared the outcome of 150 patients in each group; the groups were matched for age, sex, Trauma Score (TS) and for the percentage of RTA victims (86%). The patients transported by helicopter sustained a mortality rate 52% less than those in the group moved by road ambulance. Rhee *et al* (12) found that patients with TS between 10 and 5 have a greater chance of survival when transported by helicopter than those carried by road ambulance. No difference was found for casualties with TS over 10. These findings suggest that patient selection is necessary to make the most effective use of helicopters. Most trauma victims can be dealt with in district hospitals, but some 5-10% benefit from the more aggressive treatment carried out in trauma centres (3). The helicopter ambulance integrates well with the trauma centre concept, being able to bypass local hospitals to carry the critically ill or injured patient to a specialised unit with more appropriate facilities.

Modern Warfare

The presence of a doctor on the helicopter is a luxury which cannot usually be afforded in wartime. However, as a result of their experiences of moving war casualties in the Six Day War in 1967 and the Yom Kippur War in 1973, the Israeli Defence Forces made elaborate preparations for the recovery of their wounded in the war in the Lebanon in 1982. Eighty-five percent of the Israeli casualties were ferried to hospital by dedicated helicopter ambulances, each of which carried a medical officer and

Fig 2. The terrain of the Falkland Islands made the helicopter the ideal vehicle for casualty evacuation.

advanced resuscitation equipment – the Air Mobile Life Support Unit (AMLSU) (13). The hospitals used were civilian hospitals in Israel, prepared for the arrival of these soldiers. In contrast, in that same year, the British Forces involved in the Falklands War did not have access to civilian hospital facilities. The terrain of the Falkland Islands (Fig 2) meant that the ideal means of transferring casualties from battlefield to field hospital was by helicopter. These aircraft were not in the dedicated ambulance role but were used when they could be spared from their primary military tasks, although one machine was allocated for transferring severely injured casualties to the hospital ship (14). Air transportation allowed casualties to be brought to hospital within minutes of injury and was described by Admiral Sir John Fieldhouse as being a major contributory factor in maintaining a low mortality rate among the casualties (14).

During the Gulf War, the large distances involved meant that air transportation was again the most practical means of getting the casualties across desert terrain to the

Fig 3. Helicopters were used extensively during Op Granby for casualty transportation.

field hospitals. Helicopters brought casualties to the forward field hospitals (Fig 3), while fixed wing aircraft conveyed them from there to hospitals in the rear.

Peacetime Services

In peacetime, Wessex and Sea King helicopters of the Royal Navy and Royal Air Force, together with Coastguard-controlled helicopters, provide a comprehensive Search and Rescue (SAR) helicopter network to cover the United Kingdom and its territorial waters (Fig 4). The primary role for the RAF and RN helicopters is the recovery of military aircrew, with a secondary role of providing assistance at civil aviation incidents. Ninety percent of SAR missions involve the rescue of civilians amounting to, on average, some 1000 persons per year. Whenever possible, SAR helicopters on rescue duties carry a medical officer. In disaster situations, the large cabin area

Fig 4. SAR missions involve the rescue of some 1000 persons per year.

allows rescue parties to be conveyed rapidly to the incident, and multiple casualties to be carried to hospital, but in general these large aircraft are not well suited to the peacetime role of helicopter ambulances.

Civilian Programmes

Dedicated civilian helicopter ambulance services in Britain started at Truro, Cornwall in 1987, with the First Air Ambulance (FAA). Because of the geography of Cornwall, with the outlying islands, the West Country is a difficult area to cover using conventional ambulances. From its base at Treliske Hospital the FAA can reach any part of Cornwall within 20 minutes (15). The helicopter improves the Ambulance Service's cost-effectiveness, doing the work of ten ambulances for the cost of seven (15,16).

Other helicopter ambulance projects have been set up in Britain, including a trial of an airborne ITU for inter-hospital transfer, by personnel from St. Bartholomew's Hos-

Fig 5. The Royal London Trust Hospital's helicopter integrates all DGHs and A & E units in the Thames Valley District.

pital (17). One notable programme is the "HEMS" project at the Royal London Trust Hospital (RLTH). This helicopter ambulance (Fig 5) has been set up with three declared intentions: (i) to transport medical personnel to the scene of an accident, (ii) to airlift casualties to the most appropriate hospital and (iii) to integrate all DGHs and A&E units in the Thames Valley District (18). The aircraft is controlled by the London Ambulance Service and can reach any site inside the M25 motorway within ten minutes (18). A study is being carried out to evaluate the improvement in trauma care brought about by the addition of the helicopter ambulance and the RLTH trauma unit.

Discussion

The helicopter has proved to be a most effective means of transporting battle casualties to medical facilities in time of war. However, this use imposes a heavy demand on helicopter resources in the field, and the helicopter can carry only a limited number of casualties. In a war with many hundreds of casualties, it would not be feasible to employ helicopters as the sole means of casualty transport.

In peacetime, the application of this military concept has been of value in providing a means of taking advanced medical help to the critically-ill or injured patient, and transporting that patient to the most appropriate medical facility. However, helicopters are extremely expensive both to purchase and to operate, and in a self-financed health system the costs may be considered to outweigh the benefits. It is difficult to predict what the helicopter ambulance will eventually find in trauma care in Great Britain, but perhaps the Armed Forces, with their helicopters and hospitals staffed by trauma-trained specialists, may have an important role to play.

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